16 September, 2011 **Global Monitoring Division Hot Items**

# Unmanned Aircraft Study of Stratospheric Water Vapor & Ozone, and Climate

**Global Monitoring Division** - **ESRL-GMD**
This story entered on 16th Sep, 2011 12:16:42 PM PST

**Introduction:** Five NOAA/ESRL and five CIRES cooperative institute scientists will operate four atmospheric instruments including two ozone sensors, one water vapor sensor, and one greenhouse gases sensor for methane, nitrous oxide, and sulfur hexafluoride on the NASA Global Hawk Unmanned Aircraft Systems (UAS) to study the earth's Tropical Tropopause Layer (TTL, 13 to 18 km). The Airborne Tropical Tropopause Experiment (ATTREX) is a series of four deployments from tropical and mid-latitude locations (Edwards AFB, California; Darwin, Australia; and TBD locations in Southeast Asia) over the next four years. The high-altitude, long-duration science flights for this deployment begin from NASA Dryden Flight Research Center in Edwards AFB, California on 7 October and end by 15 November. At least one test flight and three science flights are planned. NOAA scientists also will assist in the flight planning and instrument integration for ATTREX.
**Background:** Changes in stratospheric water and ozone have large impacts on the energy budget and climate of the earth's atmosphere. Recent work has shown that small changes to stratospheric humidity are as significant as those from decadal changes in the greenhouse gases. Future changes in stratospheric humidity and ozone in response to climate changes are significant climate feedbacks. Climate feedbacks remain the biggest uncertainty in climate models. Satellite observations of water vapor have detected extremely low values of water vapor in the upper atmosphere of the tropics, and will be a major focus of this study.
The Global Hawk UAS flights were part of the 2010 Global Hawk Pacific Experiment (GloPac), which demonstrated flights up to 28.6 hr duration, altitudes as high as 19.8 km and a maximum range of 9200 nm while carrying a payload of in situ and remote instrumentation for atmospheric chemical and aerosol tracers. With the addition of a remote transportable ground station for ATTREX, the Global Hawk UAS is a very capable platform for sampling the broad expanses of the tropics over the Indian and Pacific Oceans, where few airports with long runways exist.
**Significance:** Study of ozone, water vapor, and greenhouse gases follows under one of NOAA's four goals, climate. While the feedback mechanism of water vapor in the troposphere is represented in most global models, the role of changes in stratospheric humidity is uncertain because of gaps in our understanding of physical and chemical processes in the TTL region of the atmosphere. The US Clean Air Act of 1990 directs both NOAA and NASA to report to Congress the status of stratospheric ozone depletion every three years. Climate feedback through colder stratospheric temperatures on ozone chemistry is an important emphasis in future international assessments on climate and ozone. Congress also has directed both NOAA and NASA to combined efforts in atmospheric research using the new technologies of UAS. NOAA is a significant partner of the NASA Global Hawk UAS platform.

**More information:** **http://www.espo.nasa.gov/attrex/**

**Contact information**

**Name:** James W Elkins
**Tel:** (303) 497-6224
**James.W.Elkins@noaa.gov**

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